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Communication System Dynamics for Effective Demand Creation

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Abstract

Recent drastic changes in a business environment have made traditional marketing communication theories further ineffective. Therefore, the purpose of this paper is to develop a new practical methodology which enables to analyze, create and manage effective demand even in a rapidly changing market environment today.

This paper firstly discusses two traditional marketing theories of consumer behaviour as well as their ineffectiveness. Secondly, the authors adopt system dynamics approach to analyze complex consumer behaviour and establish a new marketing communication model called Communication System Dynamics (CSD). Finally, the CSD is demonstrated its effectiveness by computer-aided simulation with some practical cases such as Moore's CASM, Xylitol Gum and iPad.

The result shows that an optimized marketing communication activities based on the CSD analysis make it possible to maximize effective demand even in a brand new market from 0% up to 97.8% at most. The authors believe that the CSD analysis can be applicable to any type of products/services sold in a market today and also beneficial to marketing practitioners who are suffering from the ineffectiveness of the traditional marketing theories.

Introduction

The ultimate purpose of marketing communication activity is to raise effective demand for the target products and services. Effective demand is an economic term that describes consumer needs and desires which are accompanied with willingness to pay. However, two environmental changes have made it more difficult to create such an effective demand in practice today.

The first reason is the saturation of information circulation in a market. According to Japanese Ministry of Internal Affairs and Communications, the average amount of information that Japanese face in a day has increased 610 times larger than that in 5 years ago(Figure 1). As a result, relative value of information to an individual has dramatically decreased and this reinforced the ineffectiveness of marketing activities such as conventional advertisement.

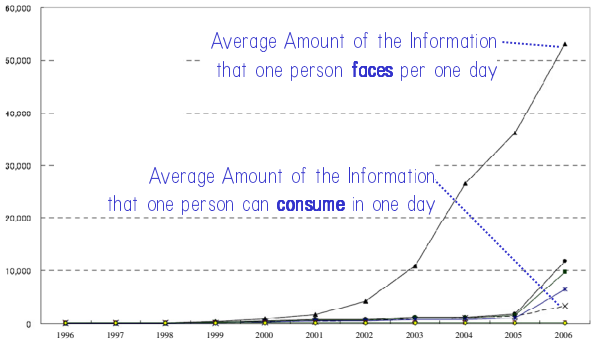


Figure 1 Saturation of the information (Information Census Research 2009: Japanese Ministry of Internal Affairs and Communications)

The second reason is the diversification of consumer need. The more ramified the consumer needs, the more expensive the cost is for customized marketing communication. Figure 2 shows diversification of alcohol consumptions in Japan. The problem is that each fragmented market tends to be too small to reach breakeven as a business and thus it has become harder to decide the optimal production volume today.

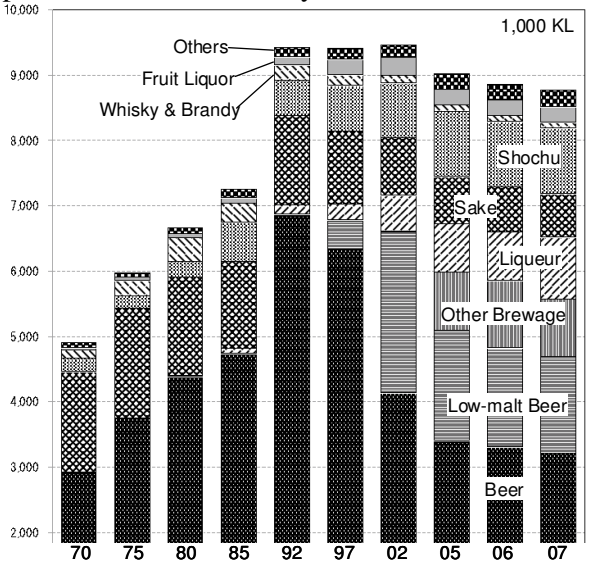


Figure 2 Diversification of the need
(The transition research of Alcohol Consumptions; Japanese National Tax Agency)

Due to the two environmental changes in the past 5 to 10 years, the existing marketing communication theories and strategies unfortunately have become ineffective in practice.

Thus, the next challenge ahead is to develop a new practical theory and strategy which enable to analyze, create and manage the effective demand in a rapidly changing market environment.

Previous Research

Two major models are well-known in the area of consumer behaviour research. Both are based on different perspectives regarding the definition of consumer being.

The first is "Stimulus - Response Model" (J. B. Watson, 1912). It defines consumer as a passive being. In other words, consumers are expected to respond in any form when receiving external stimulus. Thus, it is assumed that the more stimulation to consumers, the more commitment or purchase happens in this model.

The most famous Stimulus – Response model is the AIDMA process (Samuel Roland Hall, 1915) which is mainly used for planning volumes and contents of advertisement or publication (Figure 3). It describes 5 sequential process of consumer behaviour in deciding a purchase, starting from 1) Attention, 2) Interest, 3) Desire, 4) Memory and 5) Action. It assumes that a certain amount of consumers take actions as long as a product is able to draw attentions and interests of consumers.

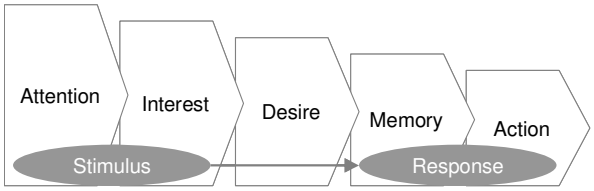


Figure 3 AIDMA process

The problem of Stimulus – Response model is that the relation between "Stimulus" and "Response" is not reasonably explained. In other words, a certain amount of investment on advertisement does not guarantee a certain amount of purchasing behavior of consumers. Just drawing attentions and interests of consumers is not good enough to justify a huge investment on advertisement. Furthermore, a simple advertisement on products or service has become less and less effective these days due to the saturation of available information in a society. Therefore, Stimulus – Response Model is not useful enough for practical marketing communication activities today.

The second is "Information Processing Model" (J. R. Bettman, 1979). It defines consumers as an active being. Every consumer is assumed to actively process information to achieve its own objective in this model. Internal motivation drives proactive personal

decision making through searching, gathering, evaluating and learning information.

Each consumer has limited capacity of information processing and allocates them to multiple target areas according to the involvement level. In general, the more involvement between a consumer and a product, the more possibility for the product name to enter "Awareness Set", "Evoked Set", "Selected Set", "Refused Set" (Brisoux and LaRoche, 1980) of the consumer (Figure 4).

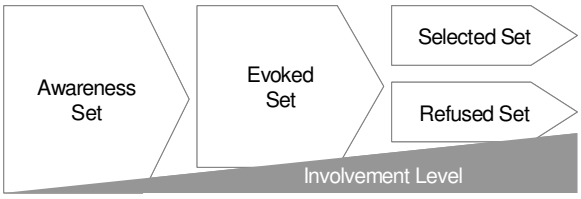


Figure 4 Brisoux and LaRoche Model

The level of involvement enhances according to consumers' proactive learning activities and increased level of conviction toward a product. Thus, the higher the level of involvement is, the more severe the "Selected Set" becomes (Sherif, M. and C, I. Hovland, 1961). However, learning and conviction totally depends on consumers' internal process and thus they are not controllable from outside. This is why existing mass marketing communication theories are not well functioned in practice.

Model Design; "Communication Systems Dynamics"

The authors adopt system dynamics approach for modelling complex behaviour of consumer today. The modelling attempts to describe the dynamic transition process of how a general consumer in a market becomes real a "customer" for a company. Two different levels of diagrams are designed for describing typical consumer behaviour. The first level is the Macro diagram which describes types of consumers in a society. The second level is the Micro diagram which describes each consumer's internal process.

Macro diagram. The authors design 4 consumer states from the top to the bottom in the macro diagram; 1) Potential adopter, 2) Interest Holder, 3) Need Holder and 4) Want Holder.

Figure 5 illustrates the fundamental inter-relation of the macro diagram and the micro diagram. Potential Adopters become Interest Holders by involvement in the issue. The transition is affected by Involvement Rate, which is designed in the micro diagram. Interest Holders become Need Holders by learning. Learning Rate affects the transition and it is also designed in the micro diagram. Need Holders become Want Holders by selecting a product. Selecting Rate affect the transition and it is also designed in the micro diagram.

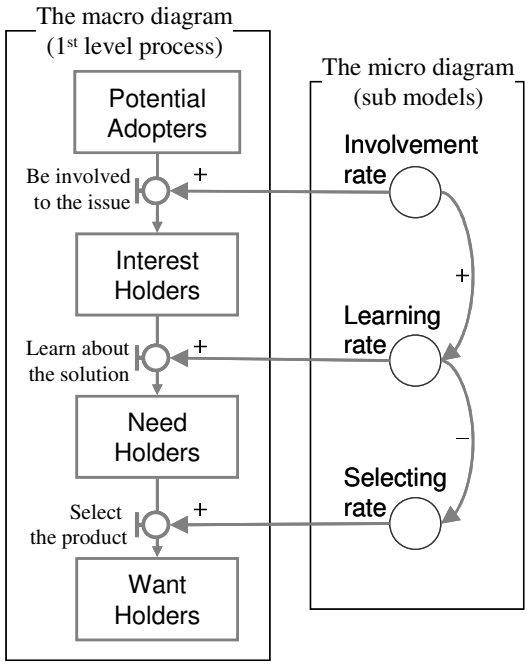


Figure 5 Macro and Micro Diagram of "Communication Systems Dynamics"

Each consumer state described above is stimulated to move forward to be the next state affected by three rates, which are respectively designed in the Micro diagram, 1) Involvement Rate, 2) Learning Rate and 3) Selecting Rate.

In this paper, the ultimate purpose is to create effective demand, which can be calculated as the total number of Want Holders.

Therefore, the authors calculate the integral of the Want Holders as in formula (1).

Effective Demand = f (WH) dt
= {SR×[NH(t)+LR×(IH(t)+IR×PA(t))]} (1)
PA: Potential Adopters
IH: Interest Holders
NH: Need Holders
WH: Want Holders
IR: Involvement Rate
LR: Learning Rate
SR: Selecting Rate

Micro diagram. Micro diagram describes three rates which affect each transition process in the Macro diagram; 1) Involvement rate, 2) Learning rate" and 3) Selecting rate. Each rate is generated by the common structure shown in Figure 6.

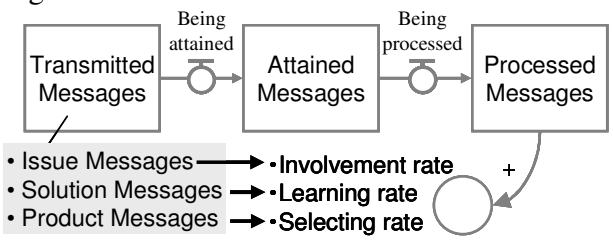


Figure 6 Common Structure of Micro Diagram

Existing study shows that the external stimulus let consumers start responding in some form, such as "Be Involved", "Learn about the solution", or ultimately "Select the product" (Stimulus - Response Model).

In general, "Interest" is actualized when issue is recognized as an own problem (Involvement rate). Also, "Need" is generated when "Solution" for the "Issue" is learned by Interest Holders (Learning rate). In the same way, "Want" is generated when closely related "Product" is appealed to Need Holders (Selecting rate).

Therefore, the authors put each "Transmitted Messages" first as an external stimulus and "Attained Messages" second as an actual input to the target consumers. "Processed Messages" are the ultimate knowledge absorbed through the internal process of consumers. Each rate is calculated as in the formula (2)

Rate of the parameters

$$= \frac{\int_0^t f\,(\text{Volume of Processed Messages})\,dt}{\text{Initial Volume of Transmitted Messages}} \quad (2)$$

The authors design two types of messages in the model. The first is the messages transmitted by a company. Thus, the volume of message is controlled by the company as Injection. The second is Buzz which is created by the third party other than the company such as consumers or media (e.g. television, magazine, newspaper, on-line-blog and so on). The flow volume of the attained messages is calculated as in formula (3). In addition, Figure 7 shows the Attainment Diagram describing the process of "Be attained". It is assumed that all the three messages have common structure.

Flow volume of the messages "Be attained"
= Volume of "Transmitted Message" ×

$$\left(\frac{\text{Injection} + \text{Buzz}}{\text{Injection} + \text{Buzz} + \text{Messages not related}}\right) \quad (3)$$

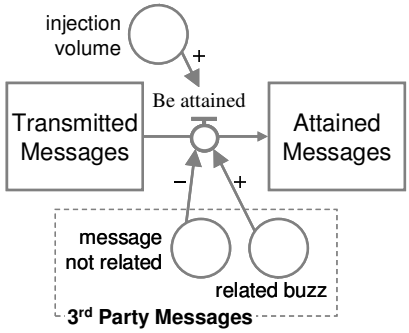


Figure 7 Attainment Diagram

Once the messages are attained, consumers start processing them to decide whether or not acquire the interest/need/want utilizing the Processing Diagram shown in Figure 8. The authors put "Processing Diagram" between "Attained" and "Processed" in order to describe the stimulation in consumer's internal process (Information Processing Model).

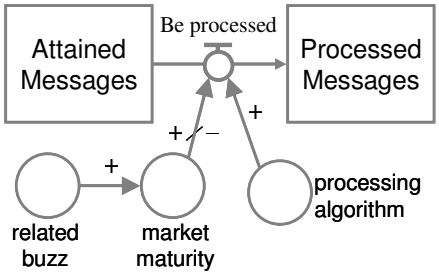


Figure 8 Processing Diagram

In addition, the authors design three sub diagrams concerning Processing Diagram; 1) Involvement Process Sub-Diagram, 2) Learning Process Sub-Diagram and 3) Selecting Process Sub Diagram.

Figure 9 shows the Involvement Process Sub-Diagram. The more issue messages are processed, the more involvement rate altered. The rate of "Be processed" varies directly proportional to the amount of "atmosphere" which is equal to the buzz by Interest / Need / Want Holders and "influence ability", which is the general malleability for the issue messages of the target consumers.

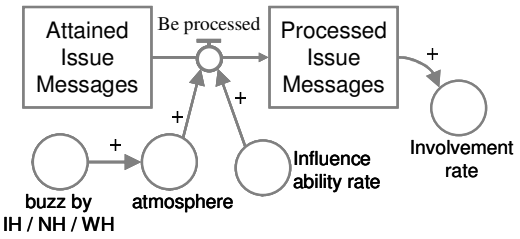


Figure 9 Involvement Process Sub-Diagram

Figure 10 shows the Learning Process Sub-Diagram. The more solution messages are processed, the more learning rate altered. The rate of "Be processed" varies directly proportional to the amount of "common knowledge" which is equal to the buzz by Need / Want Holders and "allocation rate of its info processing capacity", the general proactiveness in learning activities which is approximate to the "involvement rate" of Involvement process.

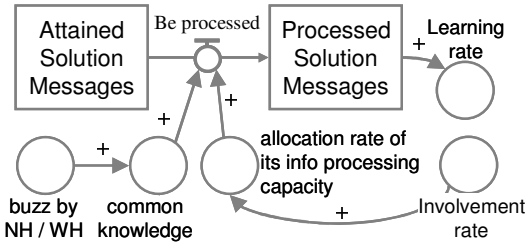


Figure 10 Learning Process Diagram

Figure 11 shows the Selecting Process Sub-Diagram. The more product messages are processed, the more selecting rate altered. The rate of "Be processed" varies directly proportional to the amount of "brand value" which is equal to the buzz by Want Holders and inversely proportional to "severity rate of the selection standard" which is approximate to the "learning rate" of Learning process. Based on the existing study (Sherif, M. and C, I. Hovland, 1961), it is well known that the higher the learning level be, the severer the selection standard be.

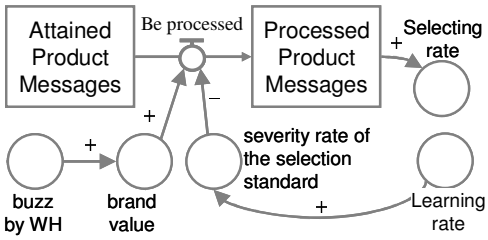


Figure 11 Selection Process Diagram

These three sub-diagrams are closely related to and mutually affected each other. Furthermore, feedback loops are designed in Figure 9, Figure 10 and Figure 11 based on the existing studies such as "May and Homans, (1977)", "Belonax, Jr. and Javalgi (1989)" and "Sugimoto (1992)"

The authors architect the CSD (Figure 12) model as a hybrid of the Macro Diagram and Micro Diagram mainly for two reasons. First, it enables to visualize how micro level consumer behaviour affects the macro level trends in the end. Second, on the other way round, it is possible to analyze how the macro level trend

gives impact on the behaviour of individual consumer in the micro level.

Furthermore, CSD assumes completely a new market. It is because the ultimate purpose of this paper is to verify the possibility to create effective demand either in the market where there is no emerged need or interest at all. Therefore, the authors set the initial values and assumptions as shown on the right.

1. 10,000 Potential Adopters.
2. No Want / Need / Interest Holders yet.
3. Potential Adopters initially process 20% of the Attained Issue Messages
4. Messages transmitted by company and Messages not related at all have same volume of 10,000.

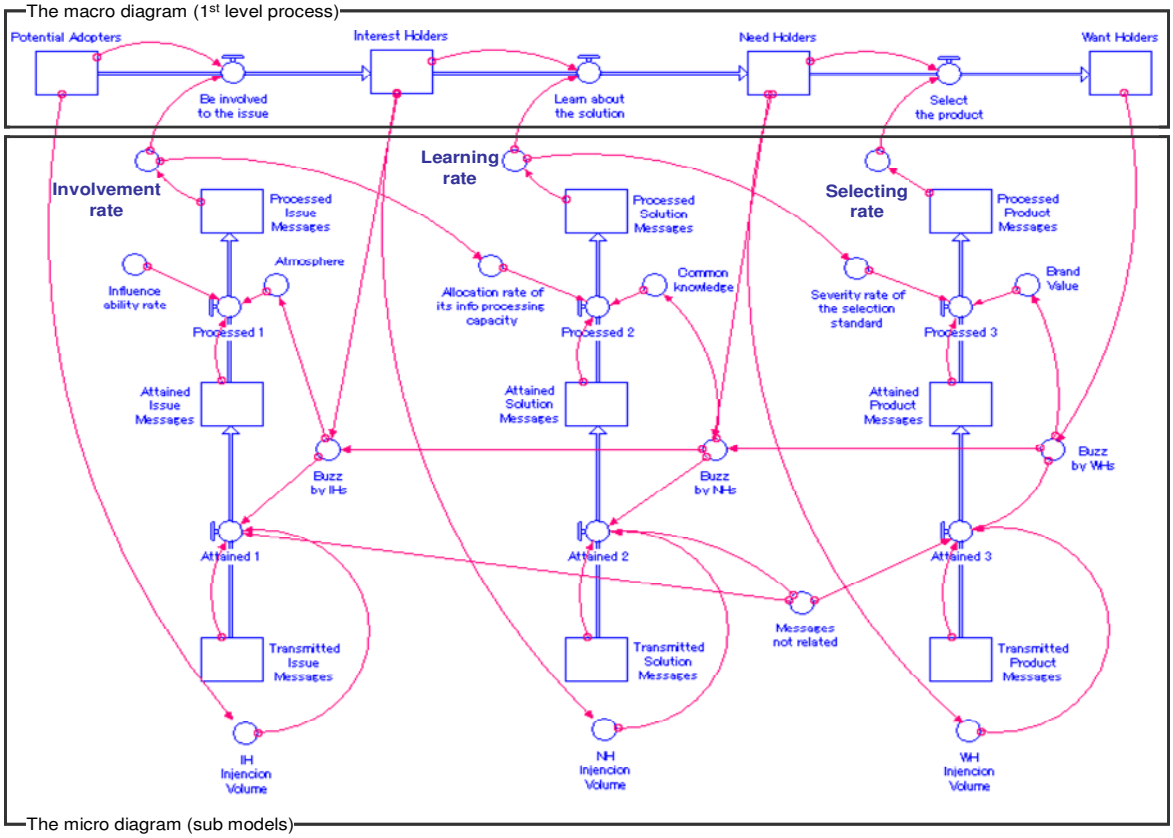


Figure 12 Overall Architecture of Communication System Dynamics (CSD)

Simulation Result

The number of Want Holders has reached to 9,780, 97.8% of the initial volume of Potential Adopters, in 12 months (1 time frame equals 1 month: average term of PDS cycle in practice) even if there is no emerged need and interest in the market (Figure 13).

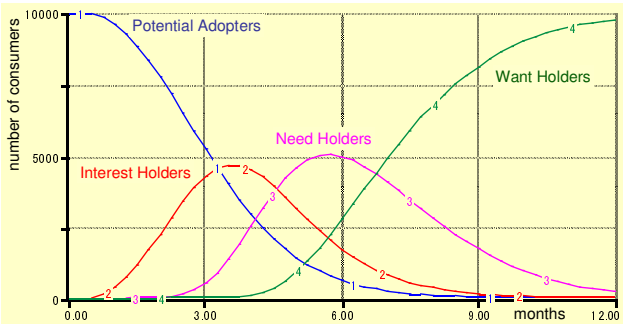


Figure 13. Transition of macro diagram

The number of "Interest Holders" achieves a peak during the first 4 months. Then, around 1 month later of it, the peak of "Need Holders" come. The number of "Want Holders" starts drawing the S-curve after the peak-out of "Interest Holders".

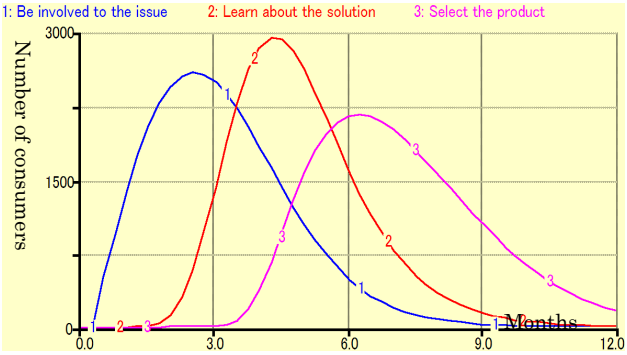


Figure 14. Key Consumer Behaviors.

In macro level, the peak of three key behaviours shift each other alternately in every 2 months and we have found that "Learn about the solution" works as an intermediaries between "Be involved to the issue" and "Select the product" as expected in advance (Figure 14). Thus, we could conclude that the smaller the variance of "Learn about the solution", the faster the generation of effective demand.

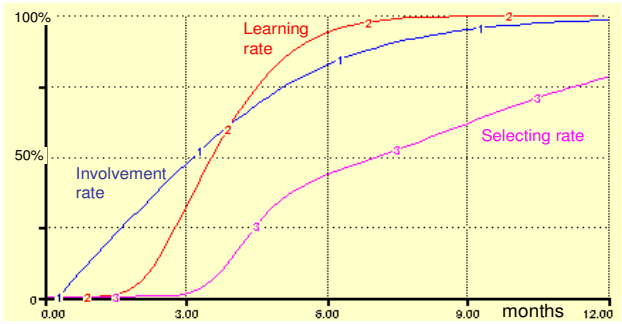


Figure 15. Impact of micro diagram.

The three key behaviours in Figure 15 are driven by the three micro diagrams. "Involvement rate" draws the line as logarithm and "Learning rate" as S-curve. The line of "Selecting rate" stands up after 3 months and acts along the S-curve until "Learning rate" reaches the peak and then, grow constantly to the end.

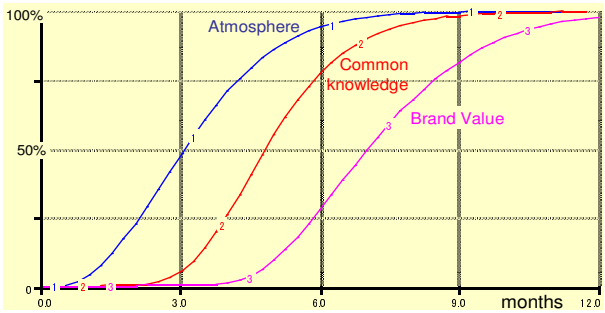


Figure 16. Atmosphere, Common knowledge, Brand Value.

In Figure 16, "Atmosphere" increases according to the macro consumers "Be involved to the issue" and "Common knowledge" to "Learn about the solution", "Brand Value" to "Select the product". These macro trends give impact on the behaviour of the individual consumers especially of the later steps.

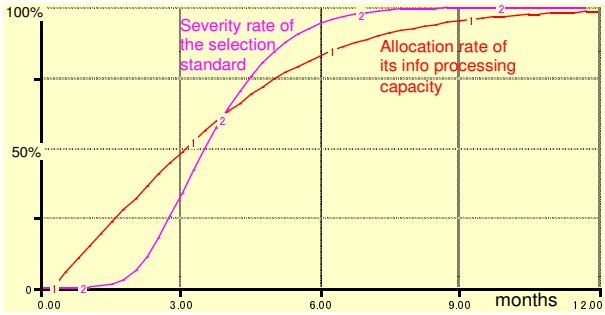


Figure 17. Allocation Rate of Information Processing Capacity and Severity Rate of the Selection Standard.

In Figure 17, "Allocation Rate of Information Processing Capacity" draws the line of logarithm and "Severity Rate of the Selection Standard" of S-curve.

Sherif and Hovland (1961) have pointed out that the higher the involvement level is, the severer the consumers becomes when selecting the products. Therefore, in the macro perspective, the ROI of marketing

communication is better before the severity rate is fully matured.

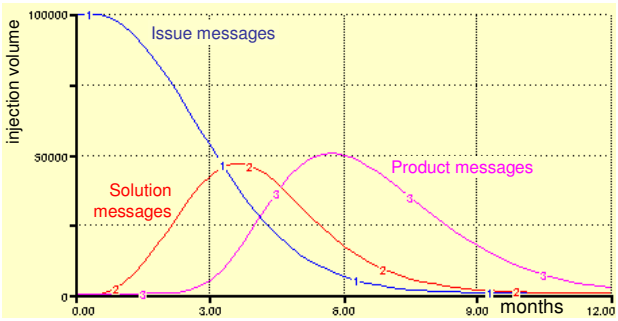


Figure 18. The Optimized Volume and Timing of each Transmitted Messages.

To maximize the number of Want Holders, the injection volume of the Issue Messages should be twice as big as the others and also be concentrated especially in the early stage (Figure 18).

Even if "Involvement rate" is a slow-acting factor, the more Potential Adopters "Be involved to the issue", the more effective demand generated as a result. Moreover, the most important result is that the Issue Messages should be transmitted at least 3 months before the Product Messages. In addition, Product Messages should be concentrated in around the sixth month when "Atmosphere" and "Common Knowledge" are fully generated and before the severity rate is matured.

Adaptation to the existing theory

Rogers (1962) proposes a diffusion model that describing adoption process of innovations as shown in Figure 19. "Innovators" (2.5%), "Early adopters" (13.5%), "Early majority" (34%), "Late majority" (34%) and "Laggards" (16%) are the four major categories and their proportions. Moore (1991) has pointed out that there is a CHASM between "Early adopters" and "Early majority" especially when a new product tries to penetrate a new market.

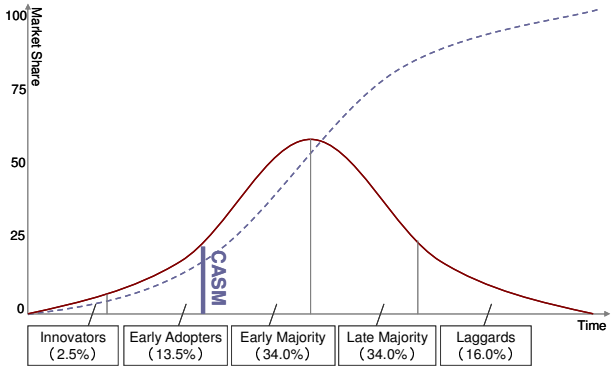


Figure 19. Diffusion of Innovations (Rogers).

Based on the basic modelling, we found that "Learn about the solution" works as an important intermediaries between "Be involved to the issue" and "Select the product".

Therefore, we decrease the initial volume of "Transmitted Solution Messages" to one third of the original.

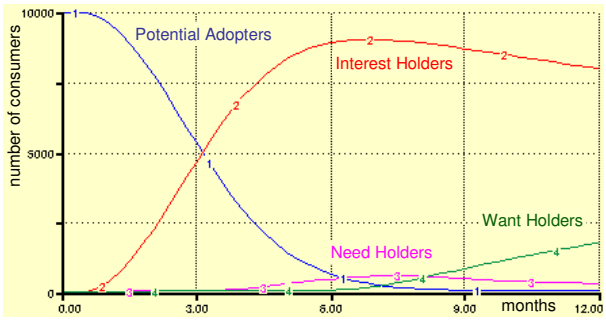


Figure 20. CHASM Simulation

As a result, in Figure 20, the number of Want Holders diminish to 1,736, 17% of the original, which is quite close to the estimate by Rogers.

Moore expected that "Innovators" and "Early Adopters" have different expectations from the others and can also buy new product without enough understanding about solutions.

The result re-examines Moore's hypothesis and shows that it is critical to optimize the volume of each transmitted messages. Otherwise, as shown in Figure 20, only "Innovators" and "Early Adopters" become the Want Holders while most of the others remain the Interest Holders.

Adaptation to past practice

The following is an application of CSD to marketing communication for Xylitol Gum (Figure 21) promotion in Japan.

Figure 21 Image of Xylitol Gum (LOTTE)

Xylitol was not well-known in Japan before 1997 in spite of the fact that it has special function of preventing tooth decay. However, the market of Xylitol Gum has grown up to be 1.2 billion dollar and acquired 66% of the entire chewing gum market share in 2004 in Japan. In other words, Xylitol gum has succeeded in creating enough effective demand by marketing communication. The macro diagram of CSD enables to visualize the process of the effective demand creation as shown in Figure 22.

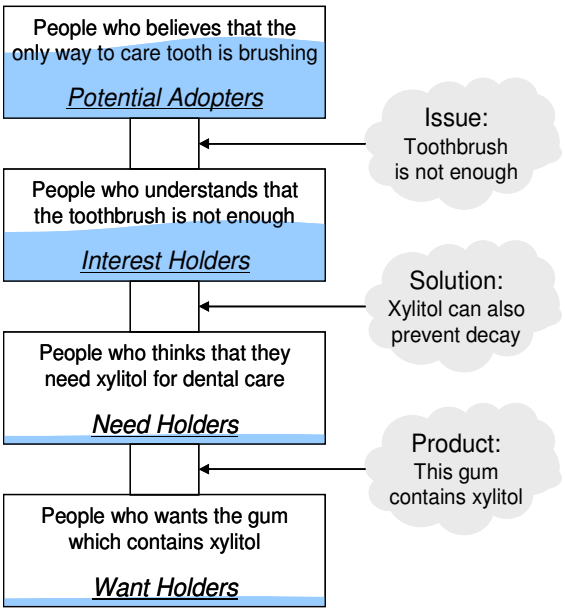
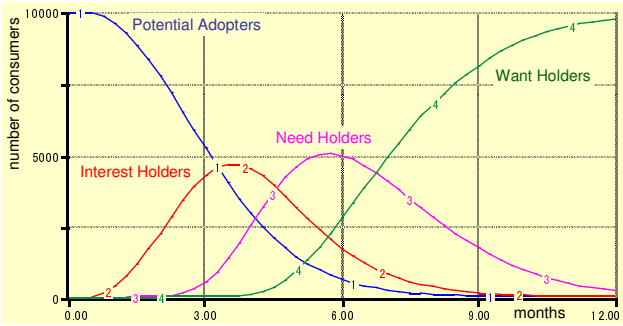


Figure 22 Macro Diagram of CSD for Xylitol Gum Campaign

In fact, the campaign succeeded in creating a strong interest toward a specific issue (e.g. preventing tooth decay) in the first step. Then, a concrete solution (e.g. Xylitol) was aligned with consumer need so that Xylitol itself has got more than 90% of the recognition in 1 year. Furthermore, positioning of their product (e.g. gum with Xylitol) was closely related to the solution. In this way, they succeeded in creating the effective demand equivalent to the volume in which 100% of the all consumer buy more than one in a year. This case shows the best approximation to the result of Figure 13 in which the CSD is theoretically optimized.



[Reinsertion]: Figure 13

The point here is that the effective demand for Xylitol would not have been created as much as today if the marketing communication activities directly focus only on the product without creating enough amounts of "Issues" (e.g. Tooth brush is not enough) in the upper stage. CSD provides an insightful view on how effective demand is created efficiently in marketing-communication practices.

Adaptation to today's practice

The following is an application of CSD to forecast the volume of effective demand for iPad (Figure 23) which is the latest product of Apple Inc.

Figure 23 Image of iPad (Apple)

Approximately 70 million people in Japan is using personal computer with Internet and they can be the potential adopter for iPad. Based on the research conducted by ASCII research institute, the author put the parameters of CSD as shown in Table 1;

Table 1: Initial Value Setting of Parameters in CSD for iPad

	Parameters	Value
Macro D	Want Holders (WHs)	1,750,000
	Need Holders (NHs)	12,040,000
	Interest Holders (IHs)	16,730,000
	Potential Adopters	39,480,000
Selecting	Buzz rate of WHs	20%
	WH Injection coefficient	10×NHs(dt)
	Messages not related	10,000
	Transmitted Product Messages	10.000
Learning	Buzz rate of NHs	20%
	NH Injection coefficient	10×IHs(dt)
	Messages not related	10,000
	Transmitted Solution Messages	10,000
Involvement	Buzz rate of IHs	20%
	Influence ability rate	20%
	IH Injection coefficient	10×PAs(dt)
	Messages not related	10,000
	Transmitted Issue Messages	10,000

In the best scenario, the number of Want Holders after 1 year will reach to 69,877,017, 99.8% of the all PC users in Japan (Figure 24).

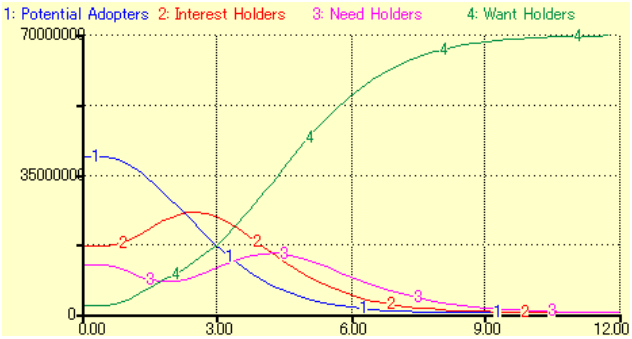


Figure 24 Best Scenario for iPad

As shown in Figure 24, there are 2 peaks of Need Holders. The first peak is generated by "Innovators" and "Early Adopters", who is regarded to be the passionate customer of Apple. Thus, as shown in Figure 25, the first sales peak comes soon after the product release. Moreover, in the best scenario, the larger sales peak will come around 4 months later than the first peak (Figure 25, "Select the product").

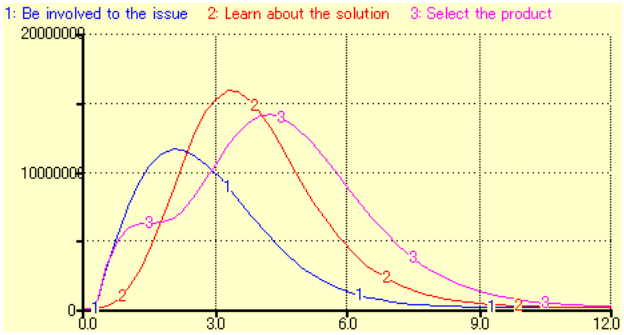


Figure 25 Consumer Behavior for iPad

To realize its best scenario, as shown in Figure 26, it is critical to prepare and transmit Solution Messages much more than now. Otherwise, the second sales peak won't come and iPad cannot overcome the CASM.

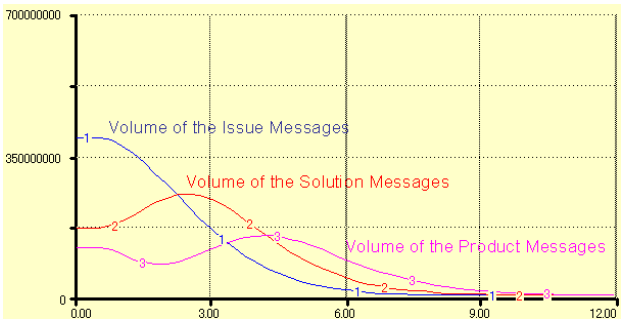


Figure 26 Required Volume of each Messages

Conclusion

This paper proposed a new approach to analyze marketing communication activity called "Communication System Dynamics". The new approach enables to visualize how the market maturities affect consumer behaviour in the end. As a result of the simulation, the authors conclude the following 5 key findings;

1. The more people move forward in the macro diagram, the stronger Buzz impact in the micro diagram.

2. Regarding the ROI, the activities are better completed before the severity rate is fully matured.
3. Issue Messages should be transmitted at least 3 months before the Product Messages. Thus, it is required that practitioners start planning the activities more than half a year before launching the product.
4. Injection volume of the Issue Messages should be twice bigger than the others and concentrated especially in early stage.
5. The volume of "Solution Messages" is critical to getting over the CHASM, as Moore's hypothesis.

The current CSD represents only a simple modelling of complex consumer behaviour in a rapidly changing market today. The tool is useful especially for analyzing optimal strategy for marketing communication and its potential results in the future. Future work must be done for applying the CSD to more variety of business cases in practice.

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Biography

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